

Application No.: 09/853217

Case No.: 55944US002

### Remarks

Claims 1-22 are pending. Claims 1-17 stand rejected and claims 18-22 have been withdrawn from consideration. By this response, claims 1 and 12 have been amended. Applicants respectfully request reconsideration of the rejected claims in view of the amendments and the following remarks.

### Claim Amendment

Claim 1 has been amended to recite that the polymerizable composition is irradiated with pulses of accelerated electrons at a pulse rate of about 500 pulses per second or more. Support for this amendment is found, for example, on page 14, lines 3-7 of the specification. No new matter is added by this amendment.

### § 102 Rejections

Claims 1, 2, 6, 8, 16, and 17 stand rejected under 35 USC § 102(b) as being anticipated by Mukohyama (U.S. Patent No. 4,886,840). The Office Action asserts that Mukohyama discloses all of the elements recited in these claims. Applicants respectfully traverse this rejection as applied to the amended claims.

A patent claim is anticipated only if each and every element as set forth in the claim is found in a single prior art reference. *Verdegal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987). As amended, claim 1 is directed to a polymerization method that involves coating a substrate with a polymerizable composition and irradiating the composition with a pulsed beam of electrons having a dose per pulse of about 10 to about 90 Gy, at a pulse rate of about 500 Hz or more, thereby polymerizing the composition. Mukohyama describes a UV and EB curable resin composition comprising acryloylmorpholine and/or methacryloylmorpholine. Mukohyama, however, does not describe irradiation of a polymerizable composition with a pulse of electrons at a dose rate of greater than or equal to about 500 pulses per second, as is recited in amended claim 1. On the contrary, according to the Examiner's calculations, Mukohyama, in column 10, lines 16-30, discloses irradiating the coating composition with an electron beam at a total dose of between 0.75 Mrad to 3 Mrad, and a dose per pulse of 0.75 Mrad (Office Action, p. 2). These figures are indicative of a very low

Application No.: 09/853217

Case No.: 55944US002

pulse rate, i.e. curing with only 1 to 3 pulses, which is a much lower pulse rate than is currently recited in claim 1 and would not produce the kind of heterogeneous polymerization that can be achieved with the present invention. Indeed, Applicants note that the Examiner has not rejected the dependent claim that recites a pulse rate limitation (i.e., claim 12) under section §102, presumably because Mukohyama does not teach pulse rates in this range.

Since Mukohyama does not disclose all of the elements of amended claim 1, this reference does not anticipate claim 1 nor any of the claims that depend directly or indirectly from claim 1, including claims 2, 6, 8, 16, and 17. Applicants, therefore, respectfully submit that the § 102(b) rejection based on Mukohyama has been overcome and should be withdrawn.

### **§ 103 Rejections**

Claims 1-17 stand rejected under 35 USC § 103(a) as being unpatentable over Weiss et al (WO 00/04055) in view of Loda (U.S. Patent No. 4,163,172), Mukohyama et al (U.S. Patent No. 4,886,840) and Botman et al (Nuclear Instruments and Methods in Physics Research B 139). Applicants respectfully traverse this rejection.

As discussed above, claim 1 as amended now recites that the polymerizable composition is irradiated at a pulse rate greater than or equal to about 500 pulses per second. None of the references cited by the Examiner describe providing a pulse rate this high. The Examiner has asserted that since total dose is a function of pulse frequency, dose per pulse and residence time, it is "not inventive to discover the optimum or workable ranges of result-effective variables by routine experimentation." (Office Action, p. 6) However, there is nothing in the cited references that would indicate that the devices for generating e-beams described therein would even have been capable of providing pulse frequencies greater than or equal to 500 Hz. For example, the upper range described by Botman is 50 Hz, which is far below the 500 Hz recited in the present claims. Thus, the present invention could not have been discovered in the course of routine optimization using the equipment and frequency ranges described in the cited references.

Moreover, Applicants have discovered that the manner in which the dose is delivered can have dramatic effects on the polymerization process itself. Specifically, when the dose per pulse is relatively low (e.g., about 10 to about 90 Gy) and the pulse rate is below about 500 Hz, the reaction takes place predominantly in the homogeneous mode because of the longer time

Application No.: 09/853217

Case No.: 55944US002

intervals between pulses (diffusion). As the frequency of the pulses is increased above about 500 Hz, the heterogeneous mode of polymerization becomes more dominant, because the shorter interval between pulses increasingly favors heterogeneous kinetics (see pp. 13-14 of the specification). This surprising and unexpected discovery is not appreciated or otherwise disclosed anywhere in the art of record. It is a totally new, highly efficient and unexpected way to achieve, for example, the advantage of heterogeneous polymerization in a single phase system. There is no precedence for this in the prior art, and therefore, the claimed invention is patentable over the cited references.

Applicants respectfully submit that the rejection of claims 1-17 under 35 USC § 103(a) has been overcome and should be withdrawn.

#### Conclusion

In view of the foregoing amendment and remarks, Applicants respectfully submit that the application is in condition for allowance. Reconsideration of the application is requested.

All communications in this case should be direct to the undersigned. If the Examiner believes a telephone discussion would be helpful to resolve any of the outstanding issue in this case, the Examiner is encouraged to call the undersigned at the number listed below.

Respectfully submitted,

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Date

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